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(54) A method and apparatus for minimizing noise from fan filter unit

(57) In order to provide a fan filter unit whereby the noise from the fan filter unit is minimised without requiring conventional sound insulation material in contact with the airflow path and without introducing contaminants from such sound insulation material into the airflow through the fan filter unit, the fan filter unit comprises at least a fan blower (12) disposed on a base plate (14), a top housing (16) coupled to said base plate (14) with an inlet opening (18) and a side housing (22) coupled to said top housing (16) for enclosing the fan filter unit, said side housing (22) further having an outlet opening, the fan (12) being for drawing air through the inlet opening (18) and for discharging air through the

outlet opening. The fan filter unit has at least a pair of S-shaped guides (24) disposed on said base plate (14) within said fan filter unit and circumferentially of said fan blower (12) for receiving air discharged therefrom; guide means (26,28) disposed within the fan filter unit and at the output of said S shaped guides (24) for diffusing the airflow therefrom; and for directing airflow to below said base plate (14); and means for evenly distributing the airflow whereby the flow of air is guided with reduced turbulence compared to a fan filter unit which does not have the S shaped guides (24) and guide means (26,28).

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Description**FIELD OF THE INVENTION**

[0001] The present invention relates to a method and apparatus for minimising noise from air moving devices. In particular, the present invention pertains to a system for reducing noise from a fan filter unit in clean room facility

BACKGROUND OF THE INVENTION

[0002] It is common for modern production and testing facility to control the particles in the air that circulates within clean room facility in order to ensure the quality of its output. Whether be it wafer dies, compact discs or memory disk drives, effective fan filter units are needed to not only keep the particles contents within the clean room at acceptable levels but also to circulate the air which the worker breathe

[0003] Such powerful fan filter units create excessive noise however. It is known that the insulation material are lined along the conduit to or within the fan filter units to reduce the noise generate by the fan blowers. Over time, however, the particles or fiber from the insulation material are dislodged from the surface and contaminate the clean room facility

[0004] The problem associated with the particle contents in clean room facility is exacerbated in confined space or enclosures such as a multi-story wafer fabrication plant. By confined space, the present invention envisages the height of the ceiling to be less than three meters. Because of the low height clearance, the noise from fan filter units is particularly pronounced

OBJECT OF THE INVENTION

[0005] It is an object of the present invention to minimise the noise generated by fan filter units without increasing the particle counts of a clean room facility connected to such units

[0006] It is another object of the present invention to minimise the noise generated by fan filter units without doing away existing fan blower in a confined clean room facility

SUMMARY OF THE INVENTION

[0007] The present invention is a system of geometric guides and baffles for directing and diffusing the external air drawn from a fan blower before distributing the flow evenly to the outlet a fan filter unit. This arrangement not only reduces the turbulence within a fan filter unit but also maintains the particle count of air drawn through the same system. Furthermore, the present invention is implemented in dimensions substantially similar to that of the fan blower. As such, the present invention minimises noise of a fan filter unit even in confined

clean room facility

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1 is a exploded, right side, perspective elevational view of the present invention being integrated as part of a fan filter unit (filter not shown)

FIG. 2 is a front, cross sectional elevational view of the system of geometric guides and baffles of the present invention together with filter of a fan filter unit

FIG. 3 is a top, plan elevational view of section A-A in FIG. 2 highlighting the S shaped guide and curved baffle of the present invention

FIG. 4 shows the locations in the fan filter units where the velocity of airflow were are measured

FIG. 5 is a chart comparing the average velocity of airflow of a fan filter unit with and without the present invention over a range of fan blower power supply (measured in Hz).

FIG. 6 is a chart comparing the noise level from a fan filter unit with and without the present invention and is measured at a location one meter directly below the outlet of the unit

DESCRIPTION OF THE EMBODIMENT OF THE INVENTION

[0009] A method and apparatus for minimising noise from a fan filter unit is described. In the following description, numerous specific details are set forth such as guides and baffles, etc. in order to provide a thorough understanding of the present invention. In other instances, well-known parts such as the motors for the fan blower and ducts connected to the fan filter units are not shown in order not to obscure the present invention

[0010] FIG. 1 is a exploded, right side, perspective elevational view of the present invention being integrated as part of a fan filter unit 10 (filter not shown). The fan filter unit comprises a fan blower 12 disposed within a base plate 14, a top housing 16 and side housings 22 respectively. The fan blower is supported in the base plate by a mounting 20 on the underside of the base plate. Not shown but crucial to the fan filter unit 10 is a motor disposed underneath the fan blower 12 for providing rotational movement for the fan blower

[0011] By itself, the fan filter unit draws air externally from an air inlet 18 and discharges it via outlet opening 19 as shown in FIG. 2. At the outlet opening is disposed a filter 32 for removing large particles or contaminants. While the fan filter unit is effectively is circulating or ven-

tilating air in clean room facility, the noise generated by such unit is annoying. It is a practice in the industry to insulate the fan filter unit by lining the interior of the fan filter with insulating materials such as sponge, PVC foam, or fiber glass. Unfortunately, over time such insulating material tend to contaminate clean room facility as particles from the surface is dislodged and introduced into the air flow through the fan filter unit. Without the knowledge of the clean room operator, the fan filter unit becomes a source of contaminant. In the process, the output from clean room facility such as wafer die, compact discs or disk drives is contaminated.

[0012] Referring again to FIG. 1, the present invention is a method and apparatus for placing geometric guides and baffles in strategic locations along the path of airflow within the fan filter unit to minimise noise from it without contaminating the air flowing through it. The present invention comprises at least a set of S shaped guides 24 disposed circumferentially the fan blower, another set of porous baffles 26 and curved baffles 28 for diffusing and directing air from the S shaped guides 24 and finally a V shaped baffle 30 below the fan blower for distributing air evenly to the filter 30.

[0013] FIG. 3 is a top, plan elevational view of section A-A in FIG. 2 highlighting the S shaped guide and curved baffle of the present invention. The S shaped guides 24 are contoured to receive the discharged air from the fan blower 12 (shown in dotted circle) and guide the flow of air with minimum amount of turbulence towards a set of perforated baffles 26. Preferably the S shaped guides are made of metallic material whose spring back effect enable the installer to install it easily by inserting it between a plurality of clips disposed on the base plate 14. The perforated baffles 26 can be a sheet of metal with a matrix of holes. In the preferred embodiment of the present invention, the holes are 3.3 mm in diameter with about 50% spacing. The perforated baffles disposed at angles of about 45 degree to diffused the air from the S shaped guides 24. Adjacent and below the lower edge of the perforated baffles 26 are disposed the curved baffles 28 for redirecting the flow of air below the base plate. Although the curved baffles 28 can take on a straight leading edge, the present invention recommends straight but sloping leading edges 35 as illustrated in FIGS 2 and 3. Note also in FIG. 3 that the placement of S shaped guides 24, the perforated baffles 26, and the curved baffles 28 are symmetrical to each other with reference to a rotational axis of 180 degrees centered at the fan blower. Last but not the least is the V shaped baffle 30 disposed below the fan blower mounting for distributing the air flow evenly before discharging it through the outlet opening 19 of the fan filter unit 10.

[0014] FIG. 5 is a chart comparing the average velocity of airflow of a fan filter unit with and without the present invention over a range of fan blower settings (measured in Hz). The average velocity of airflow is measured at fifteen different points in the fan filter unit and illustrated in FIG. 4 respectively. Referring to FIG.

5. one can appreciate that the average velocity of a fan filter unit with the present invention is higher and more even than that without the present invention. It is evident that pressure loss of a fan filter unit having the present invention is less than that without the present invention. As such, considerable energy saving over time can be achieved.

[0015] Finally and most importantly, FIG. 6 is a chart comparing the noise level from a fan filter unit with and without the present invention and is measured at a location one meter directly below the outlet of the unit. Measured one meter below a fan filter unit, the present invention allows the fan filter unit to operate with far less noise than one without the present invention.

[0016] While the present invention has been described particularly with reference to FIGS. 1 to 6 with emphasis on a method and apparatus for minimising noise from a fan filter unit, it should be understood that the figures are for illustration only and should not be taken a limitation on the invention. In addition, it is clear that the method and apparatus of the present invention have utility in many applications where noise reduction is required. It is contemplated that many changes and modifications may be made by one of ordinary skill in the art without departing from the spirit and the scope of the invention as described.

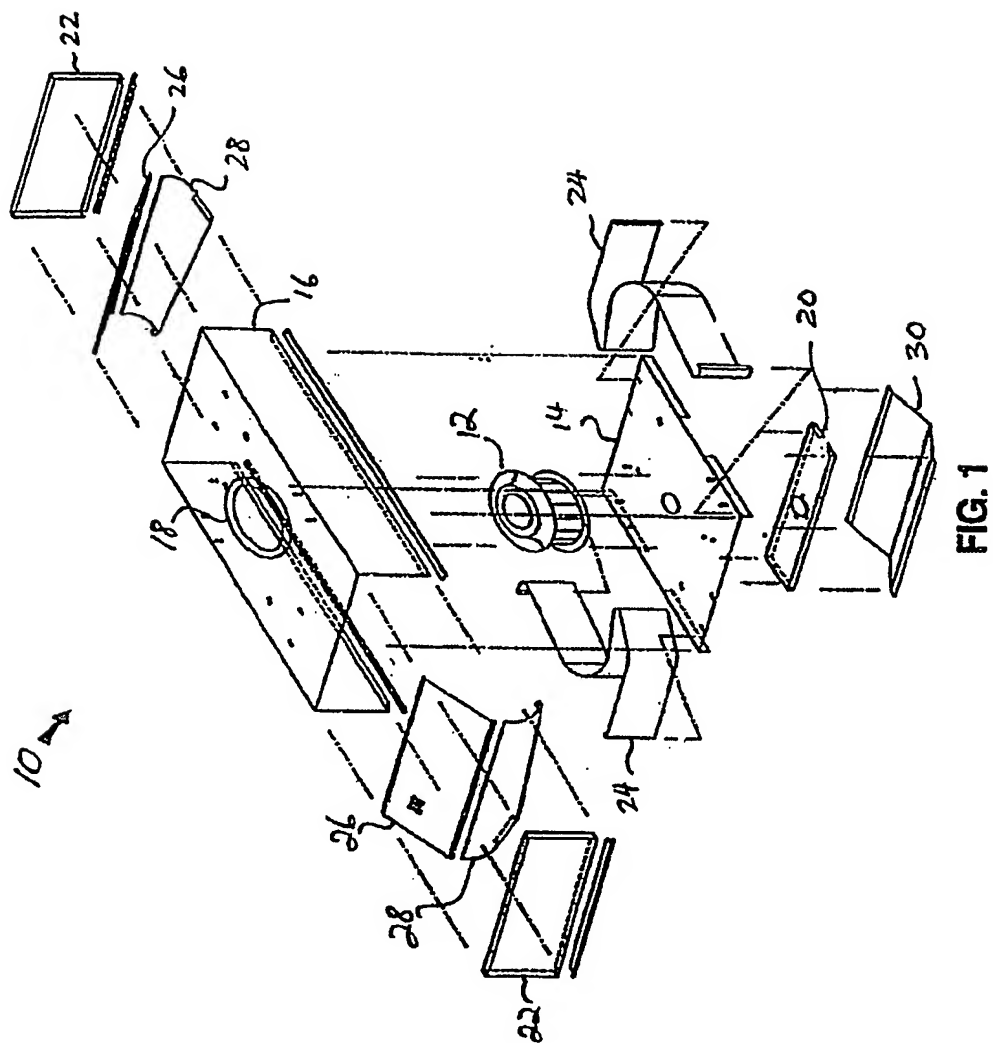
Claims

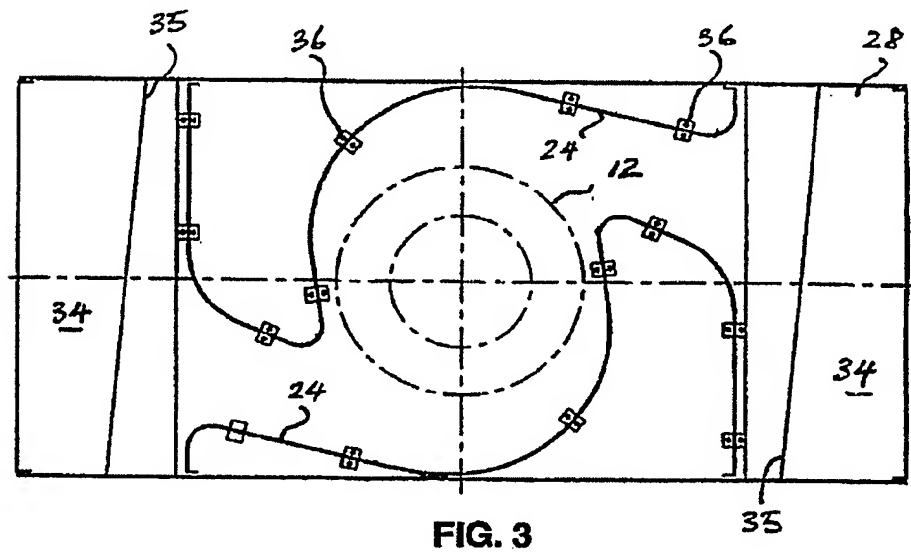
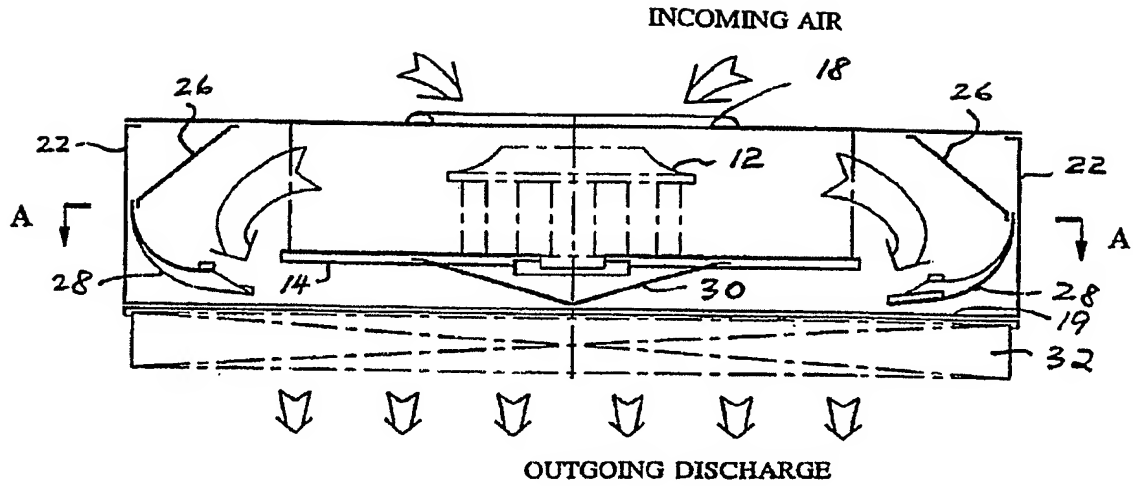
1. A fan filter unit, said fan filter unit comprising at least a fan blower (12) disposed on a base plate (14), a top housing (16) coupled to said base plate (14) with an inlet opening (18) and a side housing (22) coupled to said top housing (16) for enclosing the fan filter unit, said side housing (22) further having an outlet opening, the fan (12) being for drawing air through the inlet opening (18) and for discharging air through the outlet opening, characterized in that the fan filter unit has
 - at least a pair of S-shaped guides (24) disposed on said base plate (14) within said fan filter unit and circumferentially of said fan blower (12) for receiving air discharged therefrom;
 - guide means (26, 28) disposed within the fan filter unit and at the output of said S shaped guides (24) for diffusing the airflow therefrom; and for directing airflow to below said base plate (14); and
 - means for evenly distributing the airflow, whereby the flow of air is guided with reduced turbulence compared to a fan filter unit which does not have the S shaped guides (24), first guide means (26) and second guide means (28), whereby the noise from said fan filter unit is minimised without requiring conventional sound insulation material in contact with the airflow path and without introducing contaminants from such sound insulation material into the airflow through the fan filter unit.

2. A fan filter unit as claimed in claim 1 wherein the guide means comprises first guide means (26) disposed within the fan filter unit and at the output of said S shaped guides (24) for diffusing the airflow therefrom and second guide means (28) disposed within said fan filter unit and adjacent to said first guide means (26) for directing airflow to below said base plate (14) 5
3. A fan filter unit as claimed in claim 2 wherein the guide means (26) comprise a pair of first baffles 10
4. A fan filter unit as in claim 3 wherein said first baffles are perforated 15
5. A fan filter unit as claimed in claim 2, wherein said second guide means comprise a pair of second baffles (28) 20
6. A fan filter unit as in claim 5, wherein said second baffles (28) are curved 25
7. A fan filter unit as in claim 5, wherein said second baffles (28) are flat 30
8. A fan filter unit as in claim 1, wherein the means for distributing the airflow comprises guide means located below the base plate (14) 35
9. A fan filter unit as in claim 8, wherein the guide means located below the base plate (14) comprises baffle means 40
10. A fan filter unit as in claim 9, wherein the baffle means for evenly distributing the airflow comprises at least one baffle (30) disposed on the underside of the base plate, the flow of air being guided with reduced turbulence compared to a fan filter unit which does not have the S shaped guide (24) guide means (26, 28) and V shaped baffle (30). 45
11. A fan filter unit as in claim 10, wherein the baffle (30) disposed on the underside of the base plate is V-shaped 50
12. A fan filter unit as in any of claims 1 to 11 wherein said S-shaped guides, said guide means (26, 28), said baffle (30) disposed on the underside of the base plate or all of them are made of metal 55
13. A fan filter unit as in claim 1 wherein said S shaped guides (24) are coupled to said base plate with a plurality of clips (36)
14. A fan filter unit as in claim 3 wherein said first baffles (26) are disposed at an angle of 45 degrees with respect to the surface of said side housing 55
15. A fan filter unit as in claim 5 wherein the lower edges of the second baffles (28) are substantially curved
16. A fan filter unit as claimed in claim 5 wherein the lower edges of the second baffles (28) between the corners are substantially straight.
17. A method for minimising noise from a fan filter unit, said fan filter unit comprising at least a fan blower (12) disposed on a base plate (14), a top housing (16) coupled to said base plate (14) with an inlet opening (18) and a side housing (22) coupled to said top housing (16) for enclosing the fan filter unit, said side housing (22) further having an outlet opening, the fan being for drawing air through the inlet opening (18) and for discharging the air through the outlet opening, said method being characterized by comprising the steps of:

providing a pair of S shaped guides (24) disposed on said base plate (14) within said fan filter unit and circumferentially of said fan blower (12) for receiving air discharged therefrom; diffusing the airflow and directing the airflow below said base plate (14) with guide means (26, 28) disposed within the fan filter unit and at the output of said S shaped guides (24); and evenly distributing the airflow;

whereby the flow of air is guided with reduced turbulence compared to a fan filter unit which does not have the pair of S shaped guides (24) and guide means (26, 28), whereby the noise from said fan filter unit is minimised without requiring conventional sound installation material in contact with the airflow path and without introducing contaminants from such sound insulation material into the airflow flowing through the fan filter unit





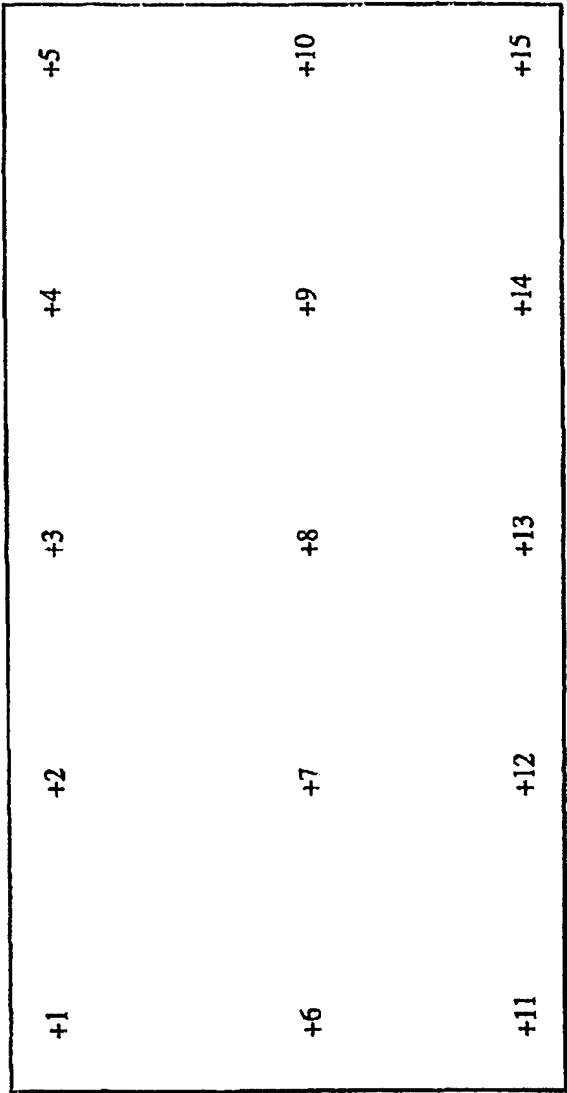
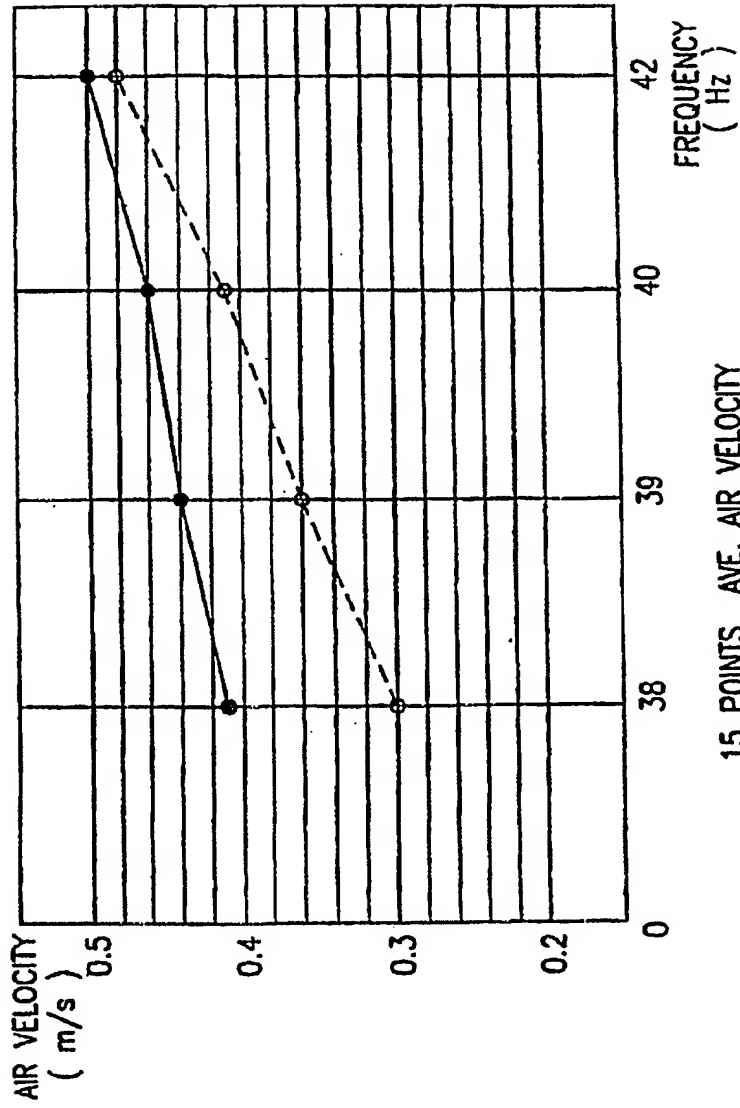


FIG. 4



LEGEND :

- FFU WITHOUT AIR GUIDE & SHEET
- FFU WITH AIR GUIDE & SHEET

FIG. 5

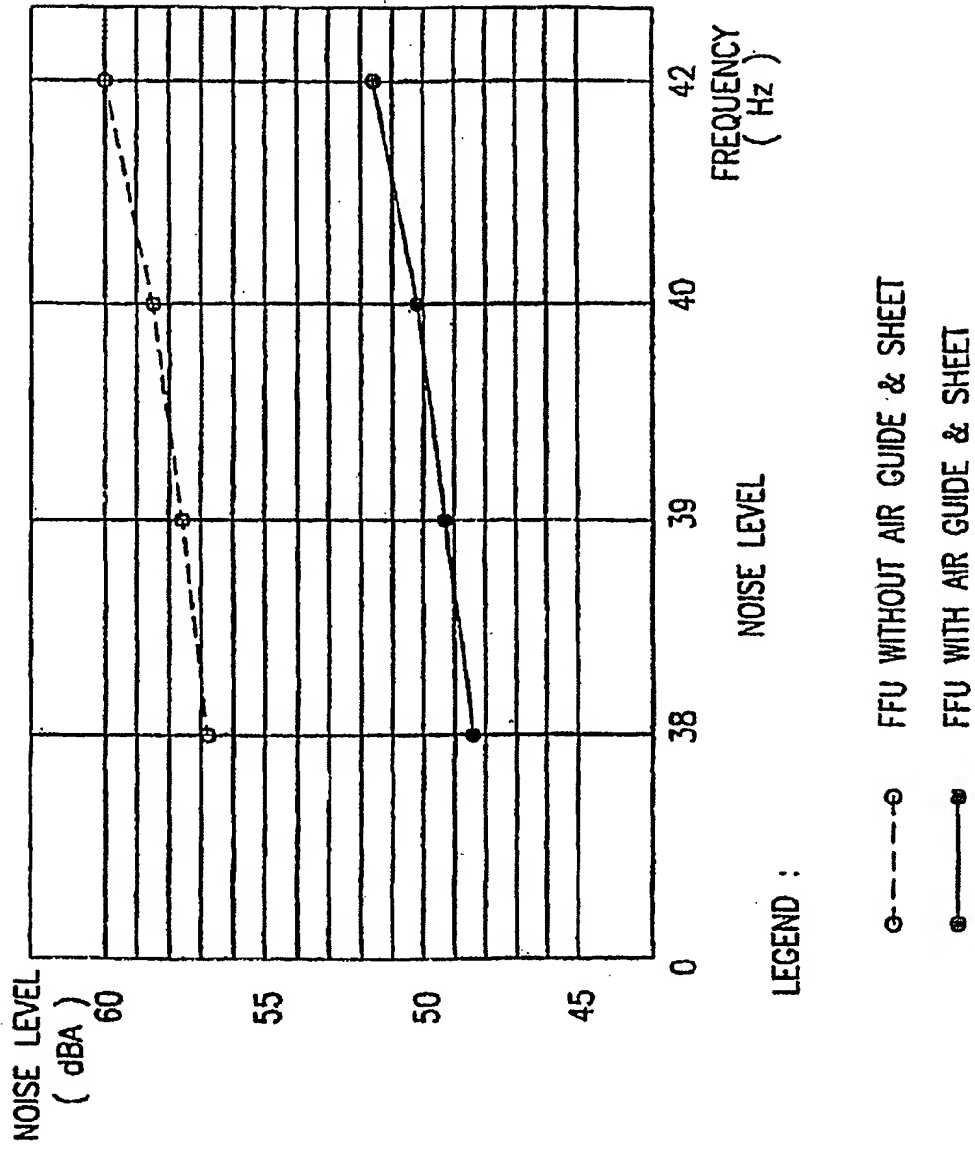


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7576

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 4 560 395 A (DAVIS GEORGE B) 24 December 1985 (1985-12-24) * column 2, line 29 - column 3, line 12 * * column 6, line 36 - column 9, line 62 * * figures 4,7,9 *	1-10, 12-17	F04D29/66 F24F7/007 F24F13/24
Y	US 4 768 424 A (WIELAND HEINZ ET AL) 6 September 1988 (1988-09-06) * column 1, line 4 - column 2, line 18 * * column 7, line 18 - column 8, line 23 * * figures 11-13 *	1-10, 12-17	
A	US 3 065 684 A (O'DAY CORTLAND N) 27 November 1962 (1962-11-27) * column 3, line 7 - column 5, line 72; figures 5,6 *	11	
A	US 4 023 472 A (GRUNDER HANS ET AL) 17 May 1977 (1977-05-17) * abstract; figures *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F04D F24F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 November 2003	Examiner Durrenberger, X
CATEGORY OF CITED DOCUMENTS		T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons & : member of the same patent family, corresponding document	
X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document			

EPO FORM 1503 03.82 (P0-C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 07 7576

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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11-11-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4560395	A	24-12-1985	BE 902186 A1	31-07-1985
			CA 1252742 A1	18-04-1989
			DE 3513902 A1	24-10-1985
			FR 2562992 A1	18-10-1985
			GB 2157765 A ,B	30-10-1985
			IT 1208803 B	10-07-1989
			NL 8500554 A ,B,	18-11-1985
US 4768424	A	06-09-1988	DE 3438710 A1	24-04-1986
			CH 669431 A5	15-03-1989
			ES 8703608 A1	01-05-1987
			FR 2572139 A1	25-04-1986
			GB 2165938 A ,B	23-04-1986
			GB 2213926 A ,B	23-08-1989
			IT 1200727 B	27-01-1989
			JP 61114036 A	31-05-1986
			NL 8502388 A ,B,	16-05-1986
			SE 460224 B	18-09-1989
			SE 8503636 A	24-04-1986
			ZA 8506475 A	30-04-1986
US 3065684	A	27-11-1962	NONE	
US 4023472	A	17-05-1977	NONE	

EPO FORM P4559

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82